

SMALL FORAMINIFERA OF THE POTTSVILLE FORMATION IN OHIO

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The Pottsville is the oldest formation of the Pennsylvanian system in Ohio. It contains four marine limestone members which may logically be expected to contain foraminifera. In ascending order these are; the Lowellville or Poverty Run, the Boggs, the Lower Mercer and the Upper Mercer limestones. Although these are spoken of as limestones, their lithologies vary from place to place. Flint, limestone, shale and iron ore may be present, either singly, or in any combination,—or the marine member of the cyclothem may be wanting altogether, due to local erosion or to nondeposition.

Each of the four limestone members was sampled at a number of points along the outcrop belt across the state. Foraminifera were found in 32 samples, in the Poverty Run, Lower Mercer and Upper Mercer limestones. As yet, I have found no microfossils in the Boggs member, which may be because they have not been preserved, or may only be the result of unlucky sampling. Foraminifera occur in all of the lithologies which may be encountered in these marine zones, but seem to be most abundant in the calcareous shales. This greater abundance may be more apparent than real;—the small fossils are more easily recovered from shales than from the harder rocks. There are localities in Scioto and Jackson counties where the Lower Mercer could be described as a "foraminiferal limestone", the hard limestone being composed very largely of the tests of the genus *Ozawainella*.

A fauna of 17 species, grouped under six families of the smaller foraminifera, has been identified. All of these forms are assigned to previously described species. The Poverty Run contained nine species, one of which, *Glomospira* cf. *G. simplex* Harlton, was found only in this member. The Lower Mercer contained 16 species, seven of which were limited to it, so far as this study is concerned. Of the five species in the Upper Mercer, no form was found that was not also present in the Lower Mercer.

A number of workers have studied the Pennsylvanian foraminifera of Texas and the Mid-Continent areas. Like the larger fossils of the Pennsylvanian, the foraminifera seem to have changed slowly and had wide geographic distribution. All of the species found in Ohio have been found, also, in the Southwest. Ten are common to both the Ohio Pottsville and to the Pennsylvanian strata of several epochs in Texas. Ten species reported from a lower Des Moinesian limestone in Indiana are found in the Pottsville in Ohio. Fourteen species found in Ohio have also been reported from Pennsylvanian rocks in Oklahoma.

The present study, then, gives further evidence that Pennsylvanian small foraminifera are long-ranging in both time and space, and in the present state of our knowledge cannot be used for close correlation of strata.

COLLECTING LOCALITIES

1. Mahoning County, Grindstone Run.
2. Mahoning County, Berlin Township, Little Mill Creek at Route 224.
3. Holmes County, Richland Township, Section 13, N.E. Quarter, at junction of road and lane which comes in from east.
4. Holmes-Coshocton County Line Road between Section 23, Richland Twp. Holmes County and Section 3, Tiverton Twp. Coshocton County.
5. Muskingum County, Falls Township, gully two miles northwest of Dillon.
6. Muskingum County, Hopewell Township, Poverty Run.

7. Muskingum County, Hopewell Township, Section 18, N.W. Quarter, at turn in the road.
8. Perry-Muskingum County Line, Limestone Hollow.
9. Perry County, Somerset Railroad cut.
10. Perry County, Reading Township, Section 22, two miles south of Somerset.
11. Hocking County, Falls Gore Township, Hocking Valley Brick Company clay pit.
12. Vinton County, Elk Township, Section 32, N.E. Quarter.
13. Jackson County, Coal Township, Section 10, Old Grace Mine.
14. Scioto County, Vernon Township, Section 24, S.W. Quarter, along the abandoned road south of Lyra.

TABLE 1
Distribution of Species

	LOCALITIES													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Hyperammina bulbosa</i> Cushman and Waters.....												×		×
<i>Spirillina concavaconvexa</i> Galloway and Rynicker.....	×		×	×		×	×	×						
<i>Ammonitella inversa</i> (Shellwien).....			×			×			×			×		
<i>Ammonitella</i> cf. <i>A. latimerensis</i> Galloway and Harlton.....			×			×			×			×	×	
<i>Ammodiscus semiconstrictus</i> var. <i>regularis</i> Waters.....					×	×		×				×	×	
<i>Clomospira</i> cf. <i>G. simplex</i> Harlton.....						×								
<i>Tolypammina confusa</i> (Galloway and Harlton).....												×		
<i>Endothyra excentralis</i> Cooper.....	×					×			×	×				
<i>Endothyra ovata</i> Waters.....	×							×				×		
<i>Endothyra rothroeki</i> Harlton.....								×	×					
<i>Endothyranella minuta</i> Waters.....	×						×	×	×		×	×		
<i>Endothyranella sobrina</i> (Plummer).....	×	×				×	×	×				×		
<i>Tetrataxis concava</i> Galloway and Rynicker.....						×			×		×		×	
<i>Tetrataxis lata</i> Spandel.....	×					×			×		×			
<i>Reophax asper</i> Cushman and Waters.....												×		
<i>Ozawainella ciscoensis</i> (Harlton).....			×		×	×						×	×	
<i>Ozawainella radiata</i> (Brady).....						×						×	×	

SYSTEMATIC PALEONTOLOGY

Order FORAMINIFERA d'Orbigny, 1826

Family ASTORRHIZIDAE Brady, 1881

Subfamily HYPERAMMININAE Cushman, 1910

Genus HYPERAMMINA Brady, 1878

***Hyperammina bulbosa* Cushman and Waters**

Figures 1-3

Hyperammina bulbosa Cushman and Waters, 1927, Cont. Cushman Lab. Foram. Res., vol. 3, pt. 2, No. 4, p. 109, pl. 22, Fig. 7.

Test free, elongate, consisting of a swollen proloculum and a long, straight second chamber with a number of slight, but noticeable, constrictions at regular intervals. The tube, however, is not divided into chambers. Aperture the open end of the tube. Shell wall very finely arenaceous with a large proportion of cement.

Average diameter of the tube approximately 0.10 mm. The length is difficult to determine because all of the specimens are broken, the pieces averaging between 0.50 mm. and 1.0 mm.

Lower Mercer limestone, Localities 12 and 14. Very abundant.

Family SPIRILLINIDAE Reuss, 1861

Subfamily SPIRILLININAE Brady, 1884

Genus SPIRILLINA Ehrenberg, 1843

Spirillina concavaconvexa Galloway and Rynicker

Figures 4-6

Spirillina concavaconvexa Galloway and Rynicker, 1930, Oklahoma Geol. Survey Circ. 21, p. 7, pl. 1, Figs. 2 a-c.

Test apparently free, minute, a single tube coiled planispirally; one side of the coil convex, the other slightly concave; coil covered with a white calcite deposit which is ornamented on the convex side by fine, radial grooves; coils slightly embracing; aperture crescentic.

Diameter of coil, 0.13 mm.; thickness of last whorl, 0.04 mm.

Poverty Run limestone, Locality 6. Rare. Lower Mercer limestone, Localities 1, 4, 6, 7 and 8. Very abundant. Upper Mercer limestone, Locality 3. Common.

Genus AMMOVERTELLA Cushman, 1928

Ammovertella inversa (Schellwien)

Figures 7-8

Test attached by the whole of one side; a long tube, closely coiling at first, then wandering off irregularly, enlarging very gradually. Schellwien describes the wall as siliceous. Galloway and Rynicker consider it to be calcareous. Some of our specimens show the characteristic noted by the latter authors of the shell substance appearing to spread out on the substratum beyond the wall proper. Surface smooth. Aperture terminal, semicircular.

Diameter of tube approximately 0.1 mm.

Poverty Run limestone, Locality 6. Very abundant. Lower Mercer limestone, Localities 6, 9 and 12. Very abundant. Upper Mercer limestone, Locality 3. Very abundant.

Remarks. There is some disagreement as to the nature and relationship of this form. Cushman, (Cont. Cushman Lab. Foram. Res. vol. 4, pt. 2, pp. 45-49) recognized several species having the same general characteristics but differing chiefly in the pattern of coiling. Galloway (Oklahoma Geol. Surv. Circular 21, p. 10) on the other hand, states that "*Ammovertella* is probably not a foraminifer at all, but a worm. The pattern made by the coiling . . . is probably a distinction not valid for species and surely not for genera."

The opinion of Helen Jean Plummer (University of Texas Bull. 3019, pt. 2, p. 44) was, "That these are true Foraminifera is shown, not only by the structure of the test in thin sections, but also by the occurrence of both microspheric and megalospheric forms To place all of these forms together is to overlook much of the data that should be used in the study of these primitive, but very useful foraminifera."

Warthin (Oklahoma Geol. Survey Bull. 53, p. 13) would lump all of the following under the name *Ammovertella inversa* (Schellwien); *Psammophis inversus* Schellwien, *P. inclusus* Cushman and Waters, *Ammovertella inversus* Cushman, *Calcitornella elongata* Cushman and Waters. *C. heathi* Cushman and Waters, *Calcivertella adherens* Cushman and Waters, *Ammovertella undulata* Galloway and Harlton, *A. latimerensis* Galloway and Harlton, and *A. adherens* Galloway and Rynicker. Warthin says, "this species is here interpreted to include all the irregularly coiled, embracing, attached forms with probably hyaline walls, found in this part of the column. The shape of each individual is determined chiefly by the proportions of the object to which it adheres. There is so much variation that, if so inclined, one could make a new species for almost every specimen."

The present writer concurs with this opinion.

Ammovertella* sp. cf. *A. latimerensis Galloway and Harlton

Figure 9

Ammovertella latimerensis Galloway and Harlton, 1928, Journ. Paleontology vol. 2, p. 342, pl. 45, figs. 3, 4.

If members of this genus are to be assigned specific names on the basis of the manner of their coiling, then certain of our specimens resemble *A. latimerensis* since, after forming a planispiral coil, the tube is bent back and forth sharply upon itself.

Lower Mercer limestone, Localities 6, 9, 12 and 13. Upper Mercer limestone, Locality 3. Very abundant.

Family AMMODISCIDAE Rhumbler, 1895

Genus AMMODISCUS Reuss, 1861

***Ammodiscus semiconstrictus* var. *regularis* Waters**

Figures 10-11

Ammodiscus semiconstrictus var. *regularis* Waters, 1928, Journ. Paleontology vol. 1, p. 132, pl. 22, fig. 2.

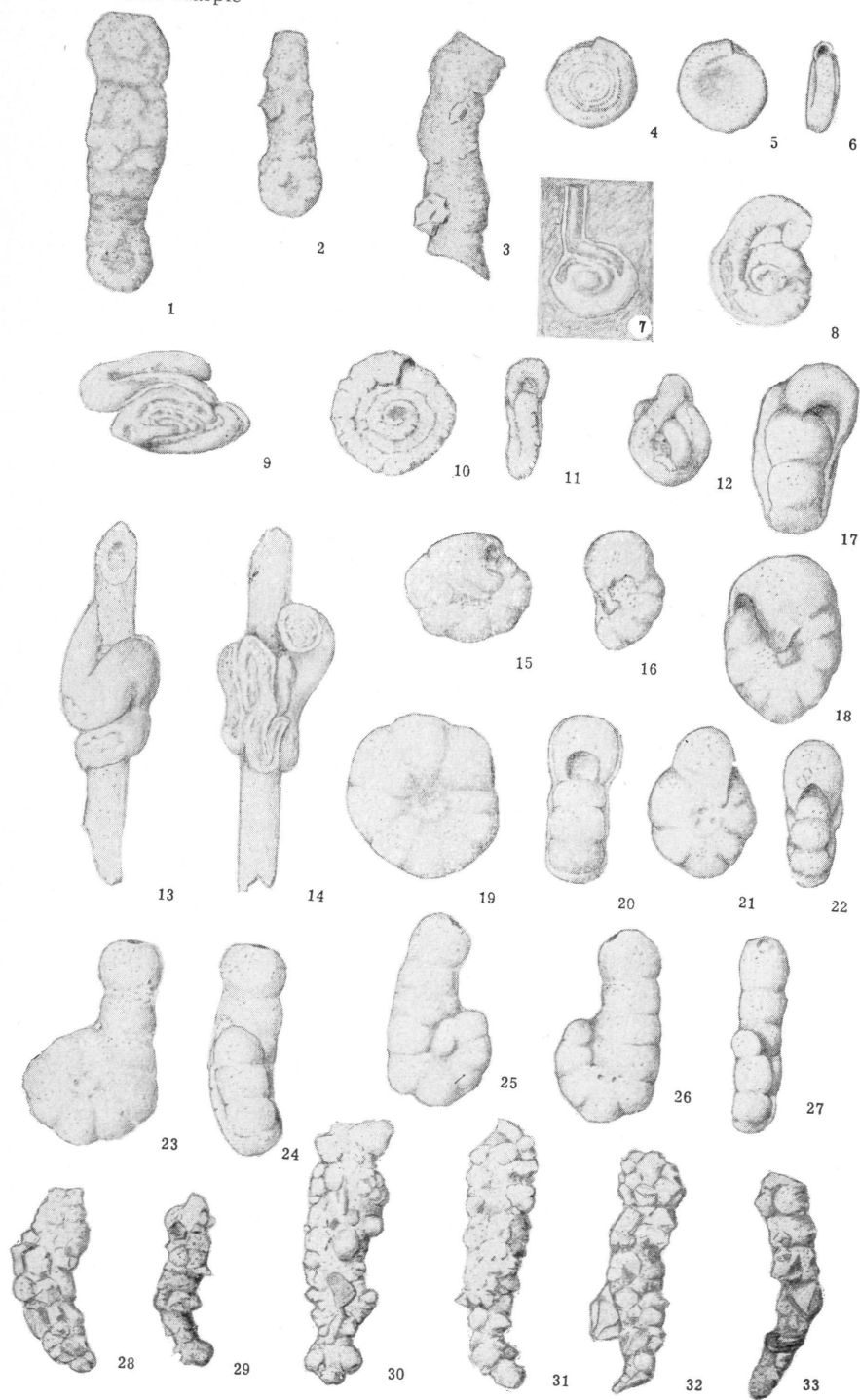
Test consisting of a proloculum and a long, undivided second chamber coiled in a nearly planispiral disc; aperture the open end of the tube; wall arenaceous.

Diameter of the test of the figured specimen, 0.27 mm.

Poverty Run limestone, Localities 5 and 6. Very abundant. Lower Mercer limestone, Localities 8, 12 and 13. Very abundant.

EXPLANATION OF FIGURES IN PLATE 1

- FIGURES 1-3. *Hyperammina bulbosa* Cushman and Waters
1, 2. Initial end, showing typically enlarged proloculum.
3. Fragment of tube, broken at both ends.
O. S. U. M. 19907, Lower Mercer Limestone, Loc. 12.
- FIGURES 4-6. *Spirillina concavaconvexa* Galloway and Rynicker
4. Lateral view, showing radial markings.
5. Opposite, or concave side.
6. Apertural view.
O. S. U. M. 19908, Shale over Lower Mercer Limestone, Loc. 9.
- FIGURES 7-8. *Ammoveritella inversa* (Schellwien)
7. Partially exfoliated specimen in matrix.
8. Another specimen, showing initial coil and variation in later coiling.
O. S. U. M. 19909, Upper Mercer limestone, Loc. 3.
- FIGURE 9. *Ammoveritella* cf. *A. latimerensis* Galloway and Harlton. Showing tube coiled back sharply upon itself.
O. S. U. M. 19911, Shale under Lower Mercer Limestone, Loc. 8.
- FIGURES 10-11. *Ammodiscus semiconstrictus* var. *regularis* Waters. Lateral and apertural views.
O. S. U. M. 19912, Shale under Lower Mercer Limestone, Loc. 12.
- FIGURE 12. *Glomospira* cf. *G. simplex* Harlton.
O. S. U. M. 19913, Poverty Run limestone, Loc. 6.
- FIGURES 13-14. *Tolypammina confusa* (Galloway and Harlton)
Opposite views of the same individual adhering to a brachiopod spine.
O. S. U. M. 19914, Lower Mercer limestone, Loc. 4.
- FIGURES 15-18. *Endothyra excentralis* Cooper
15, 16. Lateral and apertural views of an individual in which the right side is involute and the left, umbilicate.
O. S. U. M. 19915, Shale under Lower Mercer limestone, Loc. 8. 17, 18. Apertural and lateral views of an individual in which the left side is involute and the right, umbilicate.
O. S. U. M. 19916, Lower Mercer limestone, Loc. 1.
- FIGURES 21-22. *Endothyra ovata* Waters
Lateral and apertural views showing rapid increase in size of chambers, and symmetry of coil.
O. S. U. M. 19917, Lower Mercer limestone, Loc. 12.
- FIGURES 19-20. *Endothyra rothrocki* Harlton
Lateral and apertural views showing gradual increase in size of chambers, and symmetry of coil.
O. S. U. M. 19918, Shale under Lower Mercer limestone, Loc. 9.
- FIGURES 23-24. *Endothyranella sobrina* (Plummer)
Lateral and peripheral views of a typical individual.
O. S. U. M. 19919, Shale over Lower Mercer limestone, Loc. 12.
- FIGURES 25-27. *Endothyranella minuta* (Waters)
25. Lateral view showing about two whorls.
26. Opposite side, showing one whorl.
27. Peripheral view.
O. S. U. M. 19920, Shale over Lower Mercer limestone, Loc. 12.
- FIGURES 28-33. *Reophax asper* Cushman and Waters
Showing variation in size and materials of test.
O. S. U. M. 19921, Lower Mercer limestone, Loc. 12.



Genus GLOMOSPIRA Rzehak, 1888

Glomospira cf. G. simplex Harlton

Figure 12

Glomospira simplex, Harlton, 1928, Journ. Paleontology vol. 1, p. 305, pl. 52, figs. 2 a-c.

Test free, nearly spherical, consisting of a proloculum and a long, tubular second chamber, irregularly coiled and wound around itself; wall arenaceous, nearly smooth, with much cement.

Diameter of test 0.18 mm.; diameter of tube, 0.05 mm.

Poverty Run limestone, Locality 6. Rare.

Genus TOLYPAMMINA Rhumbler, 1895

Tolypammina confusa (Galloway and Harlton)

Figures 13-14

Ammonvertella? confusa Galloway and Harlton, 1928, Journ. Paleontology vol. 2, p. 344, pl. 44, fig. 5.

Tolypammina confusa Galloway and Rynicker, 1930, Oklahoma Geol. Survey Circ. 21, p. 11, pl. 1, fig. 14.

A long tube, coiled in an irregular, confused mass, attached usually to brachiopod spines; wall very finely arenaceous; surface nearly smooth. All of our specimens are broken and neither the proloculum nor the aperture is shown.

Diameter of tube, 0.1 mm. or slightly less.

Lower Mercer limestone, Locality 12. Rare to common.

Family ENDOTHYRIDAE Rhumbler, 1895

Subfamily ENDOTHYRINAE Brady, 1884

Genus ENDOTHYRA Phillips, 1846

Endothyra excentralis Cooper

Figures 15-18

Endothyra excentralis Cooper, 1947, Jour. Paleontology vol. 21, p. 88, pl. 20, figs. 19-23.

Test small, free, an asymmetrical, nautiloid coil, about eight chambers in the last volution; chambers inflated, especially the last; one side involute, the other umbilicate; aperture crescentic extending from the center of the margin down the umbilicate side.

Diameter, average, 0.32 mm.

Remarks.—Our specimens average smaller than the type, whose diameter is given as 0.48 mm. In describing the species, Cooper speaks only of forms having the right side involute and the left side umbilicate. Among our specimens there are also individuals which are the mirror image of these, the left side being involute and the right side umbilicate.

Poverty Run limestone, Locality 6. Rare. Lower Mercer limestone, Localities 1, 9 and 10. Rare.

Endothyra ovata Waters

Figures 21-22

Endothyra ovata Waters, 1928, Journ. Paleontology vol. 1, p. 274, pl. 42, fig. 6.

Test free, almost planispiral, partially involute, chambers rounded, increasing rapidly in size, about seven or eight in final whorl; aperture arched, at the base of the septal face.

Diameter of figured specimen, 0.33 mm.

Lower Mercer limestone, Localities 1, 8 and 12. Very abundant.

Endothyra rothrocki Harlton

Figures 19-20

Endothyra rothrocki Harlton, 1928, Journ. Paleontology vol. 1, p. 306, pl. 52, fig. 3.

Test free, planispiral, nearly bilaterally symmetrical, umbilicate; margin rounded, lobate; nine chambers in final whorl, increasing very gradually in size; aperture a low crescent at the base of the septal face.

Diameter, 0.35 mm.

Lower Mercer limestone, Localities 8 and 9. Rare.

Genus *ENDOTHYRANELLA* Galloway and Harlton, 1930***Endothyranella sobrina* (Plummer)**

Figures 23-24

Endothyranella armstrongi subsp. *sobrina* Plummer, 1944, Texas Univ. Bull. 4401, p. 242, pl. 16, figs. 12-17.

Early portion of test coiled like *Endothyra*, later portion a series of chambers set in a row, tangent to the coil; chambers inflated, increasing in size very gradually; about nine chambers in the last whorl of the coil, three to seven rectilinear chambers; early portion of the coil somewhat obscured by secondary calcite deposits.

Average diameter of coil, 0.27 mm., average length, 0.49 mm.

Poverty Run limestone, Locality 6; Lower Mercer limestone, Localities 1, 2, 6, 7, 8 and 12; Upper Mercer limestone, Locality 3. Very abundant.

***Endothyranella minuta* (Waters)**

Figures 25-27

Endothyranella minuta Galloway and Rynicker, 1930, Oklahoma Geol. Survey Circ. 21, p. 14, pl. 2, figs. 5 a-c, 6 a-c.

Test small, early portion coiled, later portion a series of three or four rectilinear chambers. The plane of coiling diverges from the plane of the rectilinear portion so that two whorls are visible on one side but only one on the other. Aperture round, terminal

Diameter of coil, 0.25 mm; total length, 0.46 mm

Lower Mercer limestone, Localities 1, 7, 8, 9, 11 and 12. Very abundant.

Subfamily TETRATAXINAE Galloway, 1933

Genus TETRATAXIS Ehrenberg, 1843

***Tetrataxis concava* Galloway and Rynicker**

Figures 34-36

Tetrataxis concava Galloway and Rynicker, 1930, Oklahoma Geol. Survey Circ. 21, p. 18, pl. 3, figs. 6 a-c.

Test apparently free, trochoid, conical; many long, narrow, arcuate chambers, four chambers in final whorl; whorls about eight in number; curve of dorsal side concave from apex to margin; ventral side concave with wide vestibule into which the aperture opens under a protecting flap.

Diameter, 0.7 mm. This is slightly smaller than the type.

Poverty Run limestone, Locality 6. Very abundant. Lower Mercer limestone, Localities 9, 11 and 13. Abundant.

***Tetrataxis lata* Spandel**

Figures 37-39

Tetrataxis conica var. *lata* Spandel, 1901, Festschrift Naturhist. Gesell. Nuremberg, p. 186, figs. 6 a, b.

Tetrataxis lata Galloway and Rynicker, 1930, Oklahoma Geol. Survey Circ. 21, p. 17, pl. 3, figs. 3 a-c.

Test free, round, conical; ventral surface very slightly concave, slope of dorsal surface nearly straight from apex to margin; four to six whorls; five chambers in the last whorl each with a small, valvular projection extending into the vestibule.

Diameter, 0.59 mm.

Poverty Run limestone, Locality 6. Rare. Lower Mercer limestone, Localities 1, 9, and 11. Very abundant.

Family REOPHACIDAE Cushman 1917

Genus REOPHAX Montfort, 1808

***Reophax asper* Cushman and Waters**

Figures 28-33

Reophax asperus Cushman and Waters, 1928, Cont. Cushman Lab. Foram. Res. vol. 4, p. 37, pl. 4, fig. 7.

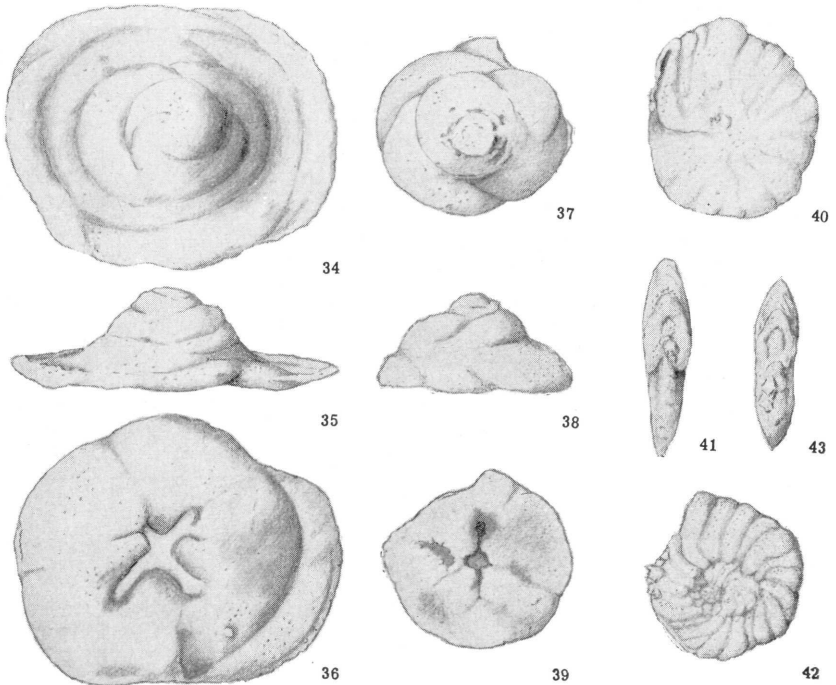
Reophax asper Cushman and Waters, 1930, Univ. Texas Bull. 3019, p. 37, pl. 2, fig. 10.

Reophax asper, Plummer, 1945, Univ. Texas Bull. 4401, p. 226, pl. 17, fig. 23.

Test elongate, very gradually expanding, round in cross section; chambers set in a slightly curved row, sutures obscure; wall arenaceous, very rough, with coarse, angular sand grains and mica flakes; aperture small, terminal.

Average length, 0.51 mm.

Lower Mercer limestone, Locality 12. Common.



FIGURES 34-36. *Tetrataxis concava* Galloway and Rynicker
Dorsal, lateral and ventral views.
O. S. U. M. 19922, Poverty Run limestone, Loc. 6.

FIGURES 37-39. *Tetrataxis lata* Spandel
Dorsal, lateral and ventral views.
O. S. U. M. 19923, Lower Mercer limestone, Loc. 11.

FIGURES 40-41. *Ozawainella radiata* (Brady)
Lateral and apertural views.
O. S. U. M. 19925, Shale under Poverty Run limestone, Loc. 6.

FIGURES 42-43. *Ozawainella ciscoensis* (Harlton)
Lateral and apertural views.
O. S. U. M. 19924, Lower Mercer limestone, Loc. 12.

All figures X60 except Figs. 4, 5 and 6 which are X120.

All figured specimens are deposited in the Geological Museum of the Ohio State University.

Family FUSULINIDAE Möller, 1878

Subfamily OZAWAINELLINAE Thompson and Foster, 1937

Genus OZAWAINELLA Thompson, 1935

Ozawainella ciscoensis (Harlton)

Figures 42-43

Staffella ciscoensis Harlton, 1928, Journ. Paleontology vol. 1, p. 307, pl. 52, figs. 9 a-c.

Orobias ciscoensis Galloway and Harlton, 1928, Journ. Paleontology vol. 2, p. 350, pl. 45, figs. 11 a-c.

Orobias ciscoensis Galloway and Rynicker, 1930, Oklahoma Geol. Survey Circ. 21, p. 15, pl. 2, figs. 9 a, b.

Oribias ciscoensis Warthin, 1930, Oklahoma Geol. Survey Bull. 53, p. 22, pl. 2, fig. 1.

Test free, planispiral, involute, peripheral margin acute; chambers short, 20 to 25 in the last whorl; aperture a high narrow arch on the septal face.

Diameter, 0.34 mm., thickness 0.08 mm.

Poverty Run limestone, Localities 5 and 6. Very abundant. Lower Mercer limestone, Localities 12 and 13. Very abundant. Upper Mercer limestone, Locality 3. Very abundant.

***Ozawainella radiata* (Brady)**

Figures 40-41

Involutina radiata Brady, 1869, Rep. Brit. Assoc. (Exeter) p. 379.

Endothyra radiata Brady, 1876, Pal. Soc. Mono. p. 97, pl. 5, figs. 10-12.

Orobias radiata Galloway and Harlton, 1928, Journ. Paleontology, vol. 2, p. 350, pl. 45, figs. 12 a-c.

Orobias radiata Galloway and Rynicker, 1930, Oklahoma Geol. Survey, Circ. 21, p. 14, pl. 2, figs. 8 a, b.

Similar to *O. ciscoensis* (Harlton) but with fewer chambers in the final whorl,—about 16. The test is also thinner in proportion to its diameter.

Diameter, 0.46 mm., thickness, 0.1 mm.

Poverty Run limestone, Locality 6, Very abundant. Lower Mercer limestone, Localities 12 and 13. Very abundant.

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